2019 AAHA Canine Life Stage Guidelines*

Kate E. Creevy, DVM, MS, DACVIM (SAIM), Jesse Grady, DVM, MS, Susan E. Little, DVM, PhD, DACVM (Parasit.), George E. Moore, DVM, PhD, DACVPM, DACVIM†, Beth Groetzinger Strickler, MS, DVM, DACVB, CDBC, Steve Thompson, DVM, DABVP (C/F), Jinelle A. Webb, DVM, MSc, DVSc, DACVIM (SAIM)†

ABSTRACT

The guidelines are an update and extension of the *AAHA Canine Life Stage Guidelines* published in 2012. A noteworthy change from the earlier guidelines is the division of the dog's lifespan into five stages (puppy, young adult, mature adult, senior, and end of life) instead of the previous six. This simplified grouping is consistent with how pet owners generally perceive their dog's maturation and aging process and provides a readily understood basis for an evolving, lifelong healthcare strategy. The guidelines provide the following recommendations for managing 10 health-related factors at each of the first four canine life stages: lifestyle effect on the patient's safety, zoonotic and human safety risk, behavior, nutrition, parasite control, vaccination, dental health, reproduction, breed-specific conditions, and a baseline diagnostic profile. (*J Am Anim Hosp Assoc* 2019; 55:267–290. DOI 10.5326/JAAHA-MS-6999)

AFFILIATIONS

From the Department of Small Animal Clinical Sciences, Texas A&M University College of Veterinary Medicine & Biomedical Sciences, College Station, Texas (K.E.C.); Department of Clinical Sciences, College of Veterinary Medicine, Mississippi State University, Mississippi State, Mississippi (J.G.); Oklahoma State University, Department of Veterinary Pathobiology, Stillwater, Oklahoma (S.E.L.); Department of Veterinary Administration (G.E.M.), and Department of Veterinary Clinical Sciences (S.T.), Purdue University, West Lafayette, Indiana; Veterinary Behavior Solutions, PLLC, Fall Branch, Tennessee (B.G.S.); and Mississauga-Oakville Veterinary Emergency Hospital, Ontario, Canada (J.A.W.).

CONTRIBUTING REVIEWERS

Lora Rickard Ballweber, DVM, MS, DACVM (Parasit.), (Microbiology, Immunology, and Pathology Department, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO); Joe Bartges, DVM, PhD, DACVIM, DACVN (Department of Small Animal Medicine and Surgery, College of Veterinary Medicine, The University of Georgia, Athens, GA); Mary L. Berg, BS, LATG, RVT, VTS (Dentistry), (Beyond the Crown Veterinary Education, Lawrence, Kansas); Philip A. Bushby, DVM, MS, DACVS (Department of Clinical Sciences, College of Veterinary Medicine, Mississippi State University, Starkville, MS); Tracey D. Jensen, DVM, DABVP (C/F) (Wellington Veterinary Hospital, Wellington, CO); Colleen S. Koch, DVM, DACVB (Mizzou Animal Behavior Clinic, Mizzou Veterinary Health Services, Wentzville, Missouri); Jason Stull, VMD, MPVM, PhD, DACVPM (Department of Health Management, Atlantic Veterinary College, University of Prince Edward Island, Charlotte, PEI); Link Welborn, DVM, DABVP (C/F), CCRT (Tampa Bay Animal Hospitals, Tampa, FL).

Correspondence: gemoore@purdue.edu (G.E.M.); jinelle.webb@vca.com (J.A.W.)

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† G. E. Moore and J. A. Webb were cochairs for the Canine Life Stage task force.

BCS (body condition score); EOL (end of life); MCS (muscle condition score); USMI (urethral sphincter mechanism incompetence)

Introduction

The purpose of these guidelines is to provide a comprehensive structure for both practice teams and pet owners that supports individualized recommendations which promote healthy longevity throughout a dog's different life stages. Specific objectives of the guidelines include

- Broadening the focus on the individualized approach to the veterinary visit.
- Emphasizing preventive healthcare strategies and recommendations based on age, size, lifestyle, and breed of the dog.
- Providing a framework and outline on focused areas of healthcare that are important during the maturation pathway at each canine life stage.
- Providing resources and relevant information for practice teams to enable them to develop an individualized preventive healthcare plan for each dog.
- Providing information and communication strategies to "make compliance easy" by facilitating adherence to recommendations that protect canine and human health.

Organizing a canine patient's lifespan into distinct life stages is a way of recognizing that a dog's physiology evolves as he matures, requiring different approaches to healthcare as the animal progresses from puppy to senior pet. The patient's life stage becomes a clinical tool that guides the clinician's risk assessment and preventive healthcare and treatment strategies. Equally important, the life stages described in these guidelines also represent a useful framework for explaining individualized pet healthcare to the pet owner. For example, a pet owner who understands why a puppy has different dietary, vaccination, behavioral, or dental care needs compared with an adult dog is more likely to comply with the practice team's recommendations at each life stage.

These guidelines complement earlier canine life stage guidelines[1] published in 2012, as well as the more recently released, *AAHA/IAAHPC End-of-Life (EOL) Care Guidelines* published in 2016. The EOL Guidelines recommended that the terminal stage of a patient's life should be considered a distinct life stage because of the unique patient and client considerations required during EOL. These guidelines will not discuss the EOL, but because of the importance of the EOL stage, we encourage practice team members to become thoroughly knowledgeable with the EOL guidelines, too.[2]

Although the 2012 guidelines can be considered a companion reference to the newer guidelines, an important distinction between the two is the task force's decision to reduce the number of canine life stages (pre-EOL) from six to four. *Note*: All subsequent discussion of the number of the life stage categories will focus on and refer to the four life stages preceding EOL. The physiologic basis for six canine life stages remains valid. However, categorizing the dog's lifespan into four segments makes clinical protocols easier to implement and, very importantly, simplifies the pet healthcare dialog between the practice team and its pet owners. Everyone in the practice, including technicians and support staff, should have an understanding of how a dog's life stage forms the basis for patient-specific healthcare recommendations. Thus, there is a dual rationale for the four life stage approach to managing the canine patient, simplifying implementation of and adherence to clinical protocols and facilitating client communication, which is the key to compliance.

The life stage guidelines represent a framework for the clinician but are not intended to be all inclusive. The AAHA website (aaha.org/caninelifestage) contains useful supporting information and resources for using life stages to guide preventive healthcare and treatment protocols for the canine patient.

Definition of Life Stages

For practical purposes, rather than attempt to calculate age equivalents to humans, the task force suggests that life stage be defined both by age and characteristics (**Table 1**). Life stage divisions, although arbitrary, provide a framework for creating individualized plans for preventive care specific to each dog's needs at the appropriate time. Table 1 provides broad-based definitions of the four life stages used in these guidelines.

These guidelines focus on life stages that require different approaches to preventive care. The spectrum of care within each life stage is affected by the age, size, lifestyle, health status, and breed of the dog.[3–5] Physiological and behavioral developmental periods do not start and end abruptly, but phase in and out gradually. Within each life stage category there will also be variation that demands clinical judgement. Because variation increases toward the latter years, estimates of inclusive ages are not uniform and therefore are not proposed for the life stages of mature adults and seniors. Estimation by the practice team of an individual dog's lifespan, generally predicted by breed lifespan, permits more accurate targeting of life stage–specific preventive care.[6] **Table 2** provides a checklist of items to discuss with each pet owner based on life stage. **Table 3** offers suggestions for resources to help predict longevity in various common breeds.

Using Life Stages to Individualize Patient Care

Each member of the veterinary team plays a vital role in providing individualized patient care to dogs regardless of life stages. At all life stages, pet owners should be encouraged to acclimate dogs to safe travel in an automobile and/or carrier prior to the veterinary visit. The team should require all pet owners to restrain dogs on a leash or in a carrier upon entering the practice and arrange the reception area to minimize encounters with other animals. Planning appointments

TABLE 1

Proposed Canine Life Stage Definitions

Stage	Definition (Length of Time)
Puppy	Birth to cessation of rapid growth (~6–9 mo, varying with breed and size)
Young adult	Cessation of rapid growth to completion of physical and social maturation, which occurs in most dogs by 3 to 4 yr of age
Mature adult	Completion of physical and social maturation until the last 25% of estimated lifespan (breed and size dependent)
Senior	The last 25% of estimated lifespan through end of life
End of life	Terminal stage (depends on the specific pathologies)

to minimize wait time, separating animals in the waiting room, and/or moving dogs directly into a quiet, calm environment can help to decrease dog and owner anxiety. Furthermore, for known anxious, fearful, aggressive, or premedicated animals, a strategy should be devised that potentially involves initial contact outside the building and entering/exiting through a door that avoids the client waiting area.

The entire veterinary team should be trained in stress-reducing handling techniques and, as appropriate, use positive reinforcement (e.g., food, treats, toys, mats) to facilitate the physical examination, diagnostic sample collection, and treatment implementation.[7,8] A calm, quiet body language and voice as well as canine pheromones may be helpful alone or in conjunction with other techniques to decrease patient stress and fear.[7,9,10] For more anxious dogs, previsit anxiolytics or sedation should be used to reduce patient stress and fear as well as provide safety for the veterinary team.[7] Should undue stress or fear develop in the dog, consider sending the dog and pet owner home, using positive reinforcement techniques only during the visit, and consider rescheduling with previsit anxiolytics.

Formal communication training, including relationship-centered communication, should be encouraged for the entire veterinary team to develop optimal communication skills. Pet owners want to be involved in the decision-making process (shared decision making) through explaining their dog's condition, available options including a recommended option, and respect of the decision they make in partnership with their veterinarian.[11] To achieve a shared decision, the veterinary team should gather information use open-ended questions (who, what, when, where, why?) and two-way communication. Implementation of two-way communication requires strategies to listen to and confirm the pet owner's perspective (e.g., reflective listening) and asking follow-up questions based on information already gathered during the visit.[11] Communication with empathy, reflective listening, and two-way communication by the veterinary team will result in improved clinical outcome as well as pet owner and veterinarian satisfaction.[12–14] Historical and physical exam information should be documented in a searchable medical record system which allows easy and clear depiction of important patient parameters (e.g., weight, vital parameters, clinical pathology values) over the life of the patient. This type of system facilitates clear communication between team members and the pet owner.

Life Stage–Based Approach to the Consultation and Physical Exam

We can't overemphasize the importance of a thorough individualized consultation and physical exam at every visit using the entire practice team. Life stage information contained in Table 2 can guide the practice team through the relevant components of the visit. The length of the visit should be based on the life stage of the dog. For example, a first puppy exam and a senior exam could require an extended period of time. The physical exam should include the five vital assessments (temperature, pulse, respiration, pain, and nutrition) as well as items listed in Table 2. Reproductive status, pain score, thoracic auscultation, gait analysis, and body mapping should also be included in the exam. Results should be recorded using a standardized scoring system (e.g., for pain evaluation, osteoarthritis staging, pruritus scores) to aid in communication, trend surveillance, and continuity of care.[15]

Puppies will have frequent visits based on their origin (shelter vs. breeder), reproductive consultation, client education needs, preventive care, and as recommended in the *AAHA Canine Vaccination Guidelines*, *AAHA/American Veterinary Medical Association (AVMA) Preventive Healthcare Guidelines*, *AAHA Canine and Feline Behavior Management Guidelines*, and AVMA/AAHA position statements (these publications are cited in their respective sections of these guidelines). Encourage a consultation and physical exam for young adults semiannually to annually and working dogs semiannually. Use open-ended questions to explore lifestyle-social changes that will affect individual care. Mature adults should have semiannual-to-annual exams, annual minimum database (**Table 4**), and exploration of biomedical as well as lifestyle-social changes using open-ended questions to aid in early disease detection. The senior dog should have at least semiannual exams and minimum database (Table 4) including similar information gathering as the mature adult with additional importance placed on empathizing with the pet owner and exploring their concerns and goals for their pet. Early detection of disease at the mature adult and senior life stage can be achieved through eliciting the pet owner's concerns and perspective, thorough physical examination, and observing trends in vital assessments.[16] This approach allows for earlier intervention in otherwise healthy-appearing dogs as well as increased lifespan and pet owner satisfaction.[12,13,16]

Working and service dogs may require more frequent visits as a result of their high-performance nature and genetics.[17] These animals not only provide companionship but also fill important

TABLE 2

Canine Life Stage Guidelines Checklist of Items to Discuss, Review, Check, and Perform

	All	Puppy	Young Adult	Mature Adult	Senior
General (PE and consultation)*	Thorough physical exam should include the 5 vital assessments: TPR, pain, and nutritional assessment (which includes body weight, BCS/MCS)	Evaluate congenital disorders			Body mapping
	Transportation advice – safety (restraint), motion sickness, anxiety	Microchip/permanent identification	Address the special needs of working/service dogs		If sedated or anesthetized for any procedure, this is an opportunity for a more comprehensive physical exam (oral, abdominal palpation, orthopedic evaluation, etc.)
	Boarding/grooming advice		Educate owners on signs of early orthopedic disease and OA. Collect pet owner observations of mobility and activity at home. Evaluate for the presence and stage of OA during PE.		
	Consult about any current medications and supplements, nutraceuticals, herbs				
	Frequency visit recommendations	Discuss future exam frequency *q* 3–4 wk	6–12 mo	6–12 mo	Educate clients on the need for more frequent examinations (at least every 6 mo) in conjunction with appropriate diagnostic screening tests.
	Provide or recommend appropriate client education online resources				
	Document and review trends on important clinical parameters in the medical record				

TABLE 2 (Continued)

	All	Puppy	Young Adult	Mature Adult	Senior
Lifestyle and safety risk assessment	Discuss/emphasize daily exercise needs appropriate to age, breed and temperament				Evaluate necessary environmental adaptations for mobility, sight, and hearing
	Exercise/mental stimulation/ enrichment appropriate for age, breed, and temperament				
	Exposure to other animals (wild/domestic)				
	Housing, confinement, temperature, humidity, and sanitation including general safety considerations				Increase awareness of the impact of mobility or vision issues in responding to environmental challenges (ability to move out of the heat, cold, navigate in the dark)
	Exposure to toxins (plants/hazards), infectious, and parasitic disease (boarding, grooming, dog parks, geographic location, travel, exposure to other animals)	Increased awareness of hazards at this age (plants, puppy-proofing, foreign body awareness)			
Zoonoses and human safety[†]	Clients should be informed on zoonotic risks relevant to their pets, themselves and family members, including but not limited to common endoparasites (e.g., hookworms, roundworm, tapeworms), dermatophytosis, toxoplasmosis, geographically relevant ectoparasite-transmitted diseases, rabies, *Salmonella*, and *Campylobacter* spp.				
	Family member risk factors to zoonotic disease transmission				
	Bite prevention education				
	Feces removal from environment				
	Discuss risks of raw food				

TABLE 2 (Continued)

	All	Puppy	Young Adult	Mature Adult	Senior
Behavior[§]	Fear and stress-reducing handling and previsit anxiolytics	Begin socializing and handling from neonate	Evaluate current behaviors of concern in relation to normal behavior	Routine evaluation for cognitive changes, anxiety/phobias and cognitive dysfunction	
	Specific evaluations for behaviors of concern	Educate on sensitive periods	Ask open-ended questions regarding behaviors that often result in relinquishment or euthanasia (house training, separation anxiety, unruly behaviors, storm and nose phobias, aggression, social relationships)		
	Discuss normal behavior	Identify problem behaviors that need further treatment	Recommend continued training classes for behavior, socialization, and well being		
	Ask open-ended questions about changes and any specific client concerns	Educate on selecting appropriate trainers			
	Advise that behavior recommendations and consultations are available	Address desensitization/ grooming needs			
	Evaluate emotional and behavioral history	Discuss bite inhibition			
		Discuss the benefits to crate training relative to housetraining, safety, and comfort			
		Encourage appropriate socialization based on the individual	Encourage adult training and active lifestyle based on the individual.		
Nutrition**	Regularly evaluate for needed change in nutrition/diet based on reproductive and health concerns	Evaluate breed and size for targeted nutrition			Identify and address comorbidities
	Conduct screening or extended nutritional assessments as indicated. See *AAHA Nutritional Assessment Guidelines* for additional information	Discuss establishing a feeding schedule and good feeding and watering habits	Establish target weight range based on BCS and MCS; important to discuss risk of weight gain after sterilization		
	Discuss supplement use				
	Use of medical records for trends/ weight, BCS/MCS				
	Modify diet per BCS/MCS			MCS is especially important to evaluate as it pertains to mobility in aging dogs	
	Evaluate the feeding schedule, food choice, and quantity		Emphasize weight control and benefits to overall health; discuss the ideal weight and muscle condition for the patient.		

TABLE 2 (Continued)

	All	Puppy	Young Adult	Mature Adult	Senior
Parasitology	Year-round control of intestinal parasites per CAPC/CDC and *AAHA/AVMA Preventive Healthcare Guidelines*.	Discuss prevalence in puppies and zoonotic potential			
		Early deworming beginning at 2 wk of age and repeating every 2 wk until started on year-round control	Continue year-round control for intestinal parasites		
	Perform routine fecal examination for intestinal parasites	Discuss high prevalence of intestinal parasites in puppies; perform more frequent fecal examinations in the first year of life	Perform fecal examination for intestinal parasites 1–4 times/yr depending on lifestyle and use of preventives.		
	Year-round heartworm preventive per CAPC and *AAHA/AVMA Preventive Healthcare Guidelines*	Start on heartworm preventive as early as label allows, no later than 8 wks of age.	Continue on heartworm preventive throughout all life stages Test annually for heartworm infection beginning at 7–12 mo of age		
	Year-round flea and tick control per CAPC Guidelines. *AAHA/AVMA Preventive Healthcare Guidelines* acknowledge clinical discretion based on risk assessment for tick control. Perform routine examination for fleas and ticks	Start on flea and tick control as early as label allows (usually 6–8 wk)	CAPC recommends year-round control for fleas and ticks throughout all life stages. *AAHA/AVMA Preventive Healthcare Guidelines* recommend year-round flea control and tick control based on risk assessment. Test annually for tick-borne infections beginning at 7–12 mo		
Vaccinations††	Evaluate risk assessment and use of non-core vaccinations as indicated, as per current AAHA guidelines	Core and noncore (if indicated) vaccines finishing at 16–20 wk	**Continue CORE vaccines per current guidelines:** **Distemper, Adenovirus-2, Parvovirus, +/- Parainfluenza:** Administer a single dose of a combination vaccine within 1 yr following the last dose in the initial vaccination series. Administer subsequent boosters at intervals of 3 yr or longer. **Rabies:** Administer a single dose of vaccine. In most states and provinces, veterinarians are allowed discretion in administering either a 1-yr or a 3-yr labeled rabies vaccine. The interval between subsequent doses is determined by the product label of the last vaccine dose administered (i.e., either 1 yr or 3 yr). For state-specific information on rabies immunization and law, www.rabiesaware.org		
	Evaluate current information about use of serology/vaccine titers		**Continue appropriate NONCORE vaccines per current guidelines and re-evaluate lifestyle and exposure risk:** *Bordetella bronchiseptica*, *Borrelia burgdorferi*, Influenza (H3N8, H3N2), Leptospira (4-serovar): Where risk of exposure is sustained, administer a single dose 1 yr following completion of the initial 2 doses, then annually thereafter or as indicated by duration of immunity studies per label.		
		Consider antibody titer testing for the purpose of determining protection from infection from CDV, CPV, and CAV2: Measuring antibody levels (quantitative or qualitative) provides a reasonable assessment of protective immunity against CDV, CPV, and CAV2.			
			The frequency of antibody testing should be based on clinical judgement but is reasonable to perform antibody testing at least as often as the interval or booster vaccination.		

TABLE 2 (Continued)

	All	Puppy	Young Adult	Mature Adult	Senior
Dentistry§§	Evaluate the existence and adequacy of home care / daily dental hygiene.	Evaluate deciduous dentition; persistent deciduous teeth; extra or incomplete dentition; oral development; and occlusion.		Evaluate the progression of any periodontal disease. Perform conscious and unconscious oral evaluation as indicated.	
	Perform oral exam and document assessment of dental condition	Discuss acceptable chew toys for dental health/safety.			
		Evaluate developmental anomalies, permanent dentition			
		Home oral hygiene training can be started in puppies with erupted, permanent dentition. Juvenile patients actively exfoliating deciduous teeth may experience discomfort associated with home dental care efforts and negative experiences should be avoided.	Consider 1st dental cleaning, oral exam and dental charting especially in dogs with malocclusions or unerupted teeth and in smaller breeds with crowded dentition. Evaluate gingival health, accumulation of plaque and calculus; missing permanent teeth should have intraoral dental radiographs taken to confirm that the teeth are truly not present.		
			Full mouth radiographs, dental cleaning/polishing, charting and scoring per *AAHA Dental Care Guidelines for Dogs and Cats*.		
Reproduction	Examine genitalia of intact and neutered/ spayed animals	Spay/neuter discussion or breeder planning/ consult.			
	Verify and document neuter/intact status.	Review literature about advances in temporary contraceptive techniques.			
		Examine for midline tattoo or place midline tattoo after spaying.			
		Intact animals: Discuss hazards of roaming, appropriate breeding frequency, genetic counseling, and breeding ages (start and finish); consider Brucellosis testing.			
		Intact animals: Evaluate reproductive health including prostate, testes, mammary gland. Obtain history of female dog heat cycles			
Breed-specific screening	Evaluate and report findings for genetic/ developmental disorders/ diseases that occur at higher frequency in certain breeds (e.g., osteoarthritis, neoplasia). Consider DNA tests for breed identification in mixed breed dogs to determine risk factors for breed-specific diseases or tendencies.	Discuss inherited disorders for all dogs in which breeding is being considered.			Screening for neoplasia and late-onset disorders; ongoing management of breed-related conditions
		Educate new owner on breed-related considerations, including breeds predisposed to allergic skin disease. Screen for abnormalities of dentition, portosystemic shunt, orthopedic, respiratory, and cardiovascular systems	Screen for orthopedic, ophthalmic, renal, hepatic abnormalities	Screen for neoplasia risk, renal, hepatic, endocrine, cardiovascular abnormalities	

*Refer to *AAHA/AVMA Preventive Healthcare Guidelines*.
†Refer to *AAHA Infection Control, Prevention, and Biosecurity Guidelines*.
§Refer to *AAHA Canine and Feline Behavior Management Guidelines*.
**Refer to *AAHA Nutritional Assessment Guidelines for Dogs and Cats*.
††Refer to *AAHA Canine Vaccination Guidelines*.
§§Refer to *AAHA Dental Care Guidelines for Dogs and Cats*.
BCS, body condition score; CAPC, Companion Animal Parasite Council; CAV2, canine adenovirus-2; CDC, Centers for Disease Control and Prevention; CDV, canine distemper virus; CPV, canine parvovirus; MCS, muscle condition score; OA, osteoarthritis; PE, physical exam; TPR, temperature, pulse, respiration.

TABLE 3

Useful Online Resources for Canine Life Stage Management

Source	URL	Information
American Veterinary Dental College	www.avdc.org	Dental information for veterinarians and pet owners
AAHA	www.aaha.org/aaha-guidelines/what-are-aaha-guidelines/	Anesthesia, dental care, nutritional assessment, pain management, senior care, and vaccination guidelines
	www.aaha.org/about-aaha/aaha-position-statements/	Positions on frequency of veterinary visit, animal welfare, and microchipping
American College of Veterinary Nutrition	www.acvn.org	List of board-certified veterinary specialists in nutrition who can provide nutritional consultation
		Downloadable booklet for pet owners on nutritional needs of dogs
		Updated links to resources for diet formulation and analysis
American Heartworm Society	www.heartwormsociety.org	Prevalence, diagnosis, and treatment of heartworm disease
American Veterinary Medical Association	https://www.avma.org/public/PetCare/Pages/default.aspx	Position statements (microchip, dog bite prevention, animal welfare, travel with animals)
	www.avma.org/news/issues/recalls-alerts/pages/default.aspx	Recalls and alerts issued regarding pet and animal feeds
American College of Veterinary Behaviorists	www.dacvb.org	Position statements, (e.g., puppy socialization)
		Information on dog bite prevention, selecting a trainer
University of Prince Edward Island	cidd.discoveryspace.ca	Diseases by breed/inheritance
Centers for Disease Control and Prevention	http://www.cdc.gov/parasites (human)	Guidelines for Veterinarians: Prevention of Zoonotic Transmission of Ascarids and Hookworms of Dogs and Cats
		Information about ecto-and endo-parasites
	http://www.cdc.gov/parasites/ascariasis(human)	Information about ticks and tick-borne infections
	http://www.cdc.gov/parasites/animals.html	
	http://www.cdc.gov/ticks/	
	https://www.cdc.gov/healthypets/index.html	
	https://stacks.cdc.gov/view/cdc/5908	
Companion Animal Parasite Council	www.capcvet.org	Internal parasite guidelines
FDA Center for Food Safety and Applied Nutrition	https://www.fda.gov/about-fda/fda-organization/office-foods-and-veterinary-medicine	Regulatory and safety issues, adverse event reporting, meetings, industry information
FDA Pet Food Sites	https://www.safetyreporting.hhs.gov/	Information, links, food safety issues, recalls, pet food labels, selecting nutritious foods, handling raw foods
	https://www.fda.gov/animal-veterinary/animal-food-feeds/pet-food	
Pet Food Institute	https://www.petfoodinstitute.org	Information on ingredient definitions, labeling regulations, current issues in pet food
University of Cambridge	http://www.vet.cam.ac.uk/idid/	Inherited diseases in dogs database

(Table continued)

TABLE 3 (Continued)

Source	URL	Information
Lifespan calculators or databases for purebred dogs	Institute of Canine Biology https://www.instituteofcaninebiology.org/lifespan.html	Charts listing the average life spans of various purebred dogs
	AKC: How long do dogs live? https://www.akc.org/expert-advice/health/how-long-do-dogs-live/	

service roles. Working and service dogs must maintain optimum health and specific physical abilities to be available to perform their special roles. Pet owners with these high-performing dogs may opt for more frequent evaluations or specific preventive care protocols.

Practitioners should familiarize themselves with AVMA and AAHA position statements regarding such procedures as ear cropping, tail docking, dew-claw removal, and ownership of wolf-dog hybrids.[18,19]

Pet Lifestyle and Safety Assessment

Safety hazards vary with the patient's life stage and lifestyle as well as with impairments of mobility, hearing, or vision. Guide the pet owner in identifying and evaluating the potential for hazards, such as

- Home and environmental toxins including toxic plants and medications
- Electric cords
- Potential foreign bodies
- Human consumables toxic to pets (e.g., xylitol, raisins)
- Temperature extremes
- Vehicle transport (restraint, temperature extremes)
- Physical hazards (e.g., sharp objects, thorns, bodies of water such as pools and ponds)
- Wildlife or other animals (infectious disease transmission, attacks, or fighting)

TABLE 4

Conduct Testing Based on Signalment and Findings in Physical Exam and History

Tests	Recommendations by Age			
	Puppy	Young Adult	Mature Adult	Senior
Fecal testing for parasites	4 in the first year	1–4 times/yr based on use of preventive product and lifestyle		
Tick-borne disease	N/A	Annually		
Heartworm	N/A	Annually; initial test is especially important to evaluate preownership status	Annually	
CBC (hematocrit, RBC, WBC, differential, cytology, platelets)	N/A	Consider for initial baseline	Annually	Every 6–12 mo
Chemistry screen At a minimum, include: TP, albumin, ALT, glucose, BUN, Creatinine, [SDMA if available]	N/A	Consider the minimum panel for initial baseline	Minimum annually (consider comprehensive)	Comprehensive every 6–12 mo
Urinalysis (specific gravity, sediment, glucose, ketones, bilirubin, protein, occult blood)	N/A	Consider for initial baseline	Annually	Every 6–12 mo
Imaging	N/A	Consider orthopedic radiographic screening for large-breed dogs	There is not enough support for general recommendation, but breed-specific screening may be indicated	
ECG	N/A		There is not enough support for general recommendation, but breed-specific screening may be indicated	

These recommendations are based on the opinion of the task force, for apparently healthy dogs and do not include recommendations for preanesthetic bloodwork.

Especially for new dog owners or new dogs at any life stage, discuss appropriate confinement and control (e.g., leash, collar, chest or head harnesses, crates), including in the home, yard, car, and during travel, to prevent the aforementioned dangers. Because free-roaming dogs are at much greater risk for disease and injury, appropriate confinement can save the lives of canine pets. Open-ended or probing questions during history-taking may indicate whether the pet is at risk as a result of inappropriate confinement, dog fighting, or hoarding conditions. Contact animal control authorities if any pet welfare violations or concerns are identified.[20]

Safety also includes planning for care in the event of owner or pet illness, accident, or natural or human-caused disasters. Discuss healthcare financial planning, disaster preparedness, and estate planning with pet owners where appropriate. Encourage appropriate registration and identification of the pet, including discussing the value of microchipping, external identification tags, and licensing.[21] Readable, current identification increases the chance of recovery of lost dogs.[22,23]

Puppies and young adults are inclined to investigate and explore, so help pet owners develop increased awareness of hazards at these life stages.[23–27] "Puppy-proof" the environment by regularly putting away toys, clothes, and shoes; ensuring security of trash containers and accessible closets or cabinets; and stabilizing furniture or items that may tip or fall. Daily exercise and mental stimulation may diminish the tendency to seek novelty from boredom as well as to provide health benefits.

Senior dogs undergo declines in mobility, vision, hearing, and cognition and may require modifications to the home environment to improve safety. Provide traction on floors and stairs or alter daily routines to minimize the need for stair-climbing as appropriate. Minimize clutter for cognitively impaired dogs who may wander aimlessly and bump into objects and furniture.[28] Be aware that senior dogs may not hear approaching vehicles well, which increases injury risk. They also may not hear approaching people or other pets and may attempt to bite when startled by an unheard pet or person.

Zoonoses and Human Safety

Veterinarians play a crucial role in protecting dogs, their families, and the public from exposure to zoonotic diseases. Dogs can serve as a sentinel for infections shared with humans. Routine evaluation and diagnostic testing to screen pet dogs for disease vectors and zoonotic infections can enhance recognition of disease risk in people.[29] Identifying local outbreaks of canine disease may be the first indication of a new or emerging pathogen that could impact human health. Immune-compromised individuals are at increased risk of acquiring zoonotic disease from pets.

As discussed in the *AAHA Infection Control, Prevention, and Biosecurity Guidelines*, the veterinary healthcare team is also at risk of acquiring zoonotic infections.[30] The practice team should perform proper hand hygiene at all times and alert the team to likely infectious animals so that possible exposure can be mitigated. Wear gloves when there is a potential for contacting a patient's bodily fluids, excrement, or when having direct or indirect contact with a potentially infectious patient. Particular caution, including limiting the dog's movement around the hospital, should be taken when examining dogs who may be infected with a zoonotic disease based on appropriate history-taking or clinical signs. Case examples include ill animals with an unknown history or overdue vaccination status for rabies and leptospirosis, especially in the face of neurologic, urinary, or hepatic clinical signs. Additionally, care should be taken when examining dogs with dermatologic changes suggestive of *Microsporum canis* infection or dogs with a history or high likelihood of a zoonotic multidrug resistant infection (e.g., methicillin-resistant *Staphylococcus aureus*). Although test specificity is less than ideal, brucellosis status should be evaluated in those dogs at risk. Risk factors for *Brucella canis* may include sterilization timing (i.e., currently intact or altered later in life), environment (i.e., living in or adopted from a shelter or a country/region where brucellosis is more common), or being used in a breeding colony without a surveillance program.[31,32]

Common zoonotic diseases are described in many textbooks and review papers and on several excellent websites (Table 3).[33,34] Basic preventive care (e.g., internal and external parasite control, vaccination) protects both canine and human health and is further enhanced by animal and environmental management to prevent pet roaming and avoid situations that may lead to dog bite (see "Behavior"). Advise pet owners to remove feces promptly and safely. Use secure fencing both to keep dogs safe when outdoors and to exclude wildlife. Be aware of regionally occurring diseases and ask pet owners about travel that might expose their pets to diseases occurring in other areas of the country or world. Remain alert to changes in geographic distribution of diseases as incidence and prevalence are continually monitored and updated.[35] Control of zoonotic ascarids is particularly important for puppies because of this life stage's greater likelihood for shedding large numbers of eggs.[36] Toxocariasis caused by human infection with *Toxocara* spp. larvae is a parasitic zoonosis that disproportionately affects children of lower socioeconomic status. Overall human seroprevalence in the United States ranges from 5.1 to 13.9% depending on the test used and the population evaluated.[37] Most infections remain subclinical, but severe ophthalmologic and visceral lesions can result. In some surveys, case rates are estimated at 1 per 1,000 people, with ocular toxocariasis possibly responsible for up to 1% of vision loss.[38] Preventive strategies include routine deworming of all dogs, prompt removal of feces, and prevention of geophagia.[33]

Pet food, particularly raw or undercooked meat, is also a source of potential zoonotic agents.[39] Many veterinary and human health organizations, including AAHA, do not advocate or endorse feeding pets any raw or dehydrated nonsterilized foods, including treats, that are of animal origin.[40] Practice staff or pet owners can monitor pet food recalls via FDA or AVMA websites. Dogs in pet therapy programs or in households with immune-compromised individuals (e.g., elderly, children <5 yr of age, pregnant, or immune-suppressed individuals) should not be fed raw food or raw treats.[1] Safe food handling should be practiced with all pets. Wash hands frequently when handling pet food, avoid feeding pets in the kitchen, use bowls designated only for pets, and wash the food bowls frequently in an area not used by people for preparation or consumption of human food. Encourage pet owners to check food packaging for expiration dates and lot numbers to enable product referrals in case of contamination or recall announcements.

Behavior

Canine behavior is influenced by developmental age, experiences, breed, and environment. Although genetics have a significant influence on behavior, individuals are a function of their genetics *and* their experiences.[41,42] Because behavior problems continue to be a significant cause of relinquishment and euthanasia, it is essential that behavioral evaluations and interventions be incorporated into each patient's veterinary visit.[43] The veterinarian is the primary resource for accurate and current information regarding behavior, and the *AAHA Canine and Feline Behavior Management Guidelines* are a useful resource for evidence-based continuing education for the practice team.[44]

The general approach to veterinary visits should attempt to reduce fear, anxiety, and stress using low-stress handling techniques and appropriate anxiolytics. Evaluations of the patient's physiological and mental state should be made by the veterinary team and recorded as part of the medical record. This will allow veterinarians and staff to adjust interactions and approach at future visits.[44]

Because developmental periods do not start and end abruptly, but rather phase in and out gradually, recommendations in Table 2 are a starting point to guide practice teams in behavioral monitoring and interventions. Each patient should be approached as an individual as opposed to applying a formulaic method. Behavioral recommendations for the four canine life stages include

For the young puppy:

- Behavioral development starts prior to arrival in the permanent home. Breeders can have significant influence on critical behavioral development in the first weeks of the patient's life. Research shows gentle handling and structured environmental exposures on a daily basis during this time period can have significant benefits later in life.[45,46]
- Despite previous recommendations regarding "socialization," a recent survey indicated only one-third of puppies were receiving exposure to people and dogs outside the home during critical periods for development.[47] Positive and structured exposure during sensitive periods are necessary for puppies to gain life skills for their future.[48,49] Additionally, the *AAHA Canine and Feline Behavior Management Guidelines* state that there is no medical reason to delay puppy classes or social exposure until the vaccination series is completed as long as exposure to sick animals is prohibited, basic hygiene is practiced, and diets are high in quality.[44]
- Veterinarians should advise pet owners regarding sensitive periods in a puppy's life such as initial exposure to people, places, animals, and things. Encourage enrollment in an appropriate puppy class and provide resources that will enable owners to create positive experiences for their pets. Be alert for signs that indicate the puppy may need more help with a particular situation; puppies generally do not "outgrow" their problems.[50] Exposure without evaluation of the puppy's response to the situation may result in increased problem behaviors as a result of sensitization instead of positive socialization which results in desensitization.
- Advise pet owners regarding selection of appropriate training professionals as coeducators for the puppy and adult dog.[51–53]

For the young and mature adult:

- The time period between ~6 mo and 3 yr of age can be the most challenging for owners as the dog matures socially and behaviorally.
- Discuss with clients normal breed-specific behaviors (such as predilections for digging or herding), individual exercise needs, and appropriate cognitive engagement to create realistic expectations of behavior and help with management of undesirable behaviors.
- Ask open-ended questions to identify common unruly behaviors that tend to occur during this age, such as jumping, barking, and mouthing. Actively question for symptoms of other undesirable behaviors, such as aggression and changes in social relationships, as safety and prevention of dog bites are a veterinary responsibility.
- Discuss areas of possible fear or anxiety. This may include fear periods, fear or anxiety associated with veterinary visits, and/or noise phobias (such as storms or fireworks). Chronic stress not only affects the owner-pet bond but also affects the health of the dog.[54]

For the senior dog:

- Schedule routine evaluation for symptoms of cognitive changes and/or dysfunction and track changes in the medical record to be able to intervene earlier in the patient's life.[55]

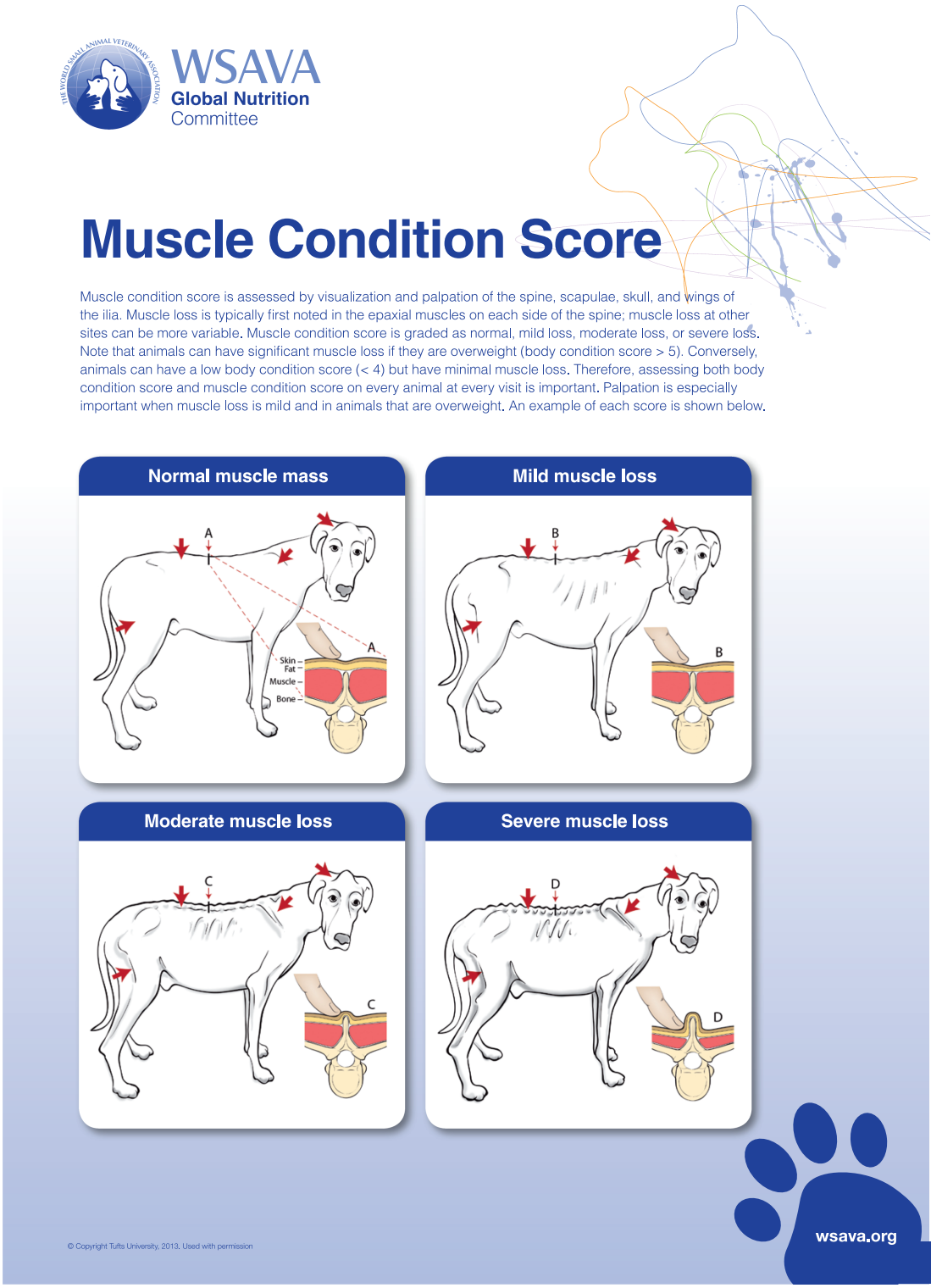

FIGURE 1 *Recommended criteria for muscle condition scoring using visual examination and palpation. Reproduced with the kind permission of the World Small Animal Veterinary Association (WSAVA).*

For all life stages:

- Refer appropriate cases to a trainer, as recommended by the American College of Veterinary Behaviorists guidelines (www.dacvb.org)
- Address normal but undesirable behaviors (such as jumping on people)
- Address unruly type behaviors such as pulling on leash
- Teach basic manners

Cases that should have referral to a veterinary behaviorist:

- Aggression toward humans or other animals
- Self-injury
- Profound phobias or fears
- Multiple concurrent diagnoses
- Patients who have not responded to the primary care veterinarian's treatments

Nutritional Assessment

Nutritional assessment should be a part of every visit to the veterinary practice and should use the entire practice team. Evaluation of the body condition score (BCS), muscle condition score (MCS), and nutritional factors can reveal a need for change in the feeding practice. MCS scoring is illustrated in **Figure 1**.[56] Factors to be evaluated at each visit include animal, diet, feeding management, and environmental factors.[56,57] Briefly, animal factors include age, physiologic status, activity, and disease processes. Diet-specific factors include type of diet (homemade versus commercially produced, raw or grain-free), amount fed, whether the food has been under recall recently, and supplements. Feeding management and environmental factors include the specifics of where and how a dog is fed.[56,57]

A complete nutritional assessment is detailed, should involve the entire veterinary team, and may involve a board-certified veterinary nutritionist. Nutritional assessment is a two-part process: (1) Screening evaluation is performed on every animal. Based on the screening, pets that are healthy and without risk factors need no additional nutritional assessment. (2) Extended evaluation is performed when one or more nutrition-related risk factors are found or suspected.

Because of the importance of a consistent practice team approach to nutritional assessment, recommendations, and protocols, there is benefit in identifying, training, and utilizing a nutrition 'champion' within the practice team. Standardized BCS and MCS results should be recorded along with the patient's weight at each visit. Ideally, these data should be stored in a searchable medical records system.[58,59] Obtaining nutritional information may require an extended consultation or additional data depending on animal, dietary, feeding management, and environmental factors.

The dog's life stage will alter the approach to the nutritional assessment. As a puppy, the focus should include evaluation of the breed and size of the dog to allow for targeted nutrition for appropriate growth. Each visit should include a discussion on establishing an appropriate feeding schedule with consideration of diet, feeding management, and environmental factors. This discussion will continue in the young adult stage, with increased focus on the target weight, BCS, and MCS. The risk of weight gain with sterilization should be discussed when appropriate.[60] It is noteworthy that 56% of dogs in the United States are overweight or obese.[61,62] Emphasis should be placed on the importance of weight control and its effect on overall health. A study involving Labrador retrievers revealed that those who maintained their ideal weight through their life stages live an average of 15% longer.[62] Clinical experience supports that this likely holds true for other breeds as well. The importance of trending the BCS, MCS, and weight will continue into the mature adult and senior life stages. MCS becomes even more important in the aging dog where the potential for reduced mobility exists.[63] In the senior dog, there are often comorbidities that should be considered when performing the nutritional assessment.[63]

Once data from the nutritional assessment are obtained, all factors should be analyzed to devise a dietary action plan. This may result in a modification to any part of the diet including the amount of food fed or environmental factors related to feeding. In many cases, a modification is not required, and monitoring can be implemented. The frequency of monitoring will depend on life stage and will be more frequent in growing, lactating, pregnant, senior, service dogs, and dogs with a disease process. Pet owner education is paramount, as there is a wealth of information and misinformation available outside of the veterinary practice. Pet owners should be educated as to how to ensure the correct amount of food is provided, how to monitor BCS and MCS themselves, and risks associated with certain feeding practices.[56,59] Because food intolerance can occur at any age, pet owners should be counseled to seek veterinary advice if the dog develops any abnormalities (e.g., gastrointestinal, dermatological) before changing food types on their own accord.[64] The *AAHA Nutritional Assessment Guidelines for Dogs and Cats* are a definitive resource for evaluating the nutritional needs of canine and feline patients at each life stage.[56]

Parasite Control

Despite the widespread availability of safe and effective treatments, internal and external parasites remain common in dogs, particularly in those who do not receive routine veterinary care.[65,66] Year-round, broad-spectrum control products with efficacy against heartworm, intestinal parasites, fleas, and ticks prevent disease in dogs by preventing the most common internal and external parasites.[67] Regular treatment for parasites also decreases environmental contamination with infective stages, thereby reducing transmission and possible

zoonotic exposure (Table 2). Treating for hookworms and ascarids is particularly important in puppies, with deworming beginning as soon as 2 wk of age and repeated every 2 wk until routine monthly treatment is initiated using products with efficacy against intestinal parasites.[66,68] Dogs remain susceptible to intestinal helminths throughout their life. These infections can be controlled by continuing monthly deworming year-round for the life of the dog. In addition, starting heartworm preventive in puppies as early as label allows, no later than 8 wk of age and 2–3 lb of body weight, and continuing year-round for the life of the dog, protects dogs from this potentially fatal disease.[69]

Fecal examination for parasites is useful to evaluate compliance with preventive use, monitor product efficacy, and screen for infection with a broad range of internal parasites. Puppies are more likely to harbor parasites and thus benefit from several fecal examinations in the first year of life.[66,70] Screening fecal samples for intestinal parasites at least annually is also important in young adult and older dogs, although more frequent testing may be warranted depending on use of preventive and overall risk assessment based on lifestyle.[67,70] Annual heartworm testing is also an important part of canine health care. Some studies report that the prevalence of canine heartworm infection in the southeastern United States has increased ~20% in recent years.[71,72] Heartworm testing beginning at 7–12 mo of age allows early detection and treatment. Heartworm testing is particularly important for young adult dogs for which prevention was delayed and for recently acquired adult dogs with an unknown history of preventive use.[67,72]

Consistent administration of ectoparasite control products is important for dogs throughout the different life stages. Although the risk of fleas and ticks is not uniform across all geographic areas and lifestyles, preventives should be in place to protect canine health and limit home infestations and subsequent zoonotic risk.[67] In the past two decades, ticks and the diseases they transmit have increased in number and intensity in North America, and several tick species have expanded geographically.[73–75] Practices should become knowledgeable of the specific risks in their area. Canine infection with some tick-borne disease agents, as evidenced by national antibody prevalence surveys, has increased 41–167%.[29] Disease, at times severe, has been associated with infection or coinfection with tick-borne pathogens.[76,77] Tick control products have been shown to limit transmission of several disease agents in both experimental and natural settings.[76–81] For these reasons, the Companion Animal Parasite Council recommends that all dogs be maintained year-round on broad-spectrum flea and tick control products, and that dogs be tested annually for infection with tick-borne pathogens.[67] The *AAHA/AVMA Preventive Healthcare Guidelines* acknowledge the appropriate use of tick control protocols based on individual patient risk assessment.[82]

Vaccination

Technologies used in the manufacturing of vaccines for animals have expanded significantly over the past decade. The number of licensed vaccines continues to grow, driven largely by the need to protect dogs against emerging pathogens, enhance vaccine safety, and improve immunogenicity of existing vaccines.[83]

Veterinarians make vaccination recommendations based on many factors, including the age and the lifestyle of each canine patient. Every dog should receive immunization with core vaccines for rabies virus, canine distemper virus, canine parvovirus, and canine adenovirus-2.[82,83] Veterinarians have considerable ability to use biologics in a discretionary manner but also should be aware of any state- or provincial-specific restrictions in their veterinary practice act for implementing regulations. Customized plans for noncore vaccines are indicated in accordance with existing guidelines.[83]

The recommended core immunization schedule is designed to protect puppies early in life when they are most vulnerable and before they are exposed to potentially life-threatening diseases. Booster vaccinations in adult and senior dogs are indicated per current guidelines and may change based on re-evaluating lifestyle and exposure risks.[82–86]

Vaccines are intended to produce active immunity to specific antigens. An adverse reaction is an undesirable side effect that occurs after a vaccination. Vaccine adverse reactions can be classified as local, systemic, or allergic. Dog owners should be informed about the benefits of and risks from vaccines and given an opportunity for questions before each vaccination procedure.

Antibody testing is increasingly being requested for canine distemper virus, canine parvovirus, and canine adenovirus-2. When assessing test results, the veterinarian should have a clear understanding of the indications for testing and the interpretation of test results. Antibody testing for the purposes of determining protection from infection is discussed at length in the *AAHA Canine Vaccination Guidelines*.[83]

Dental Care

With appropriate care, oral and dental disease and associated pain can be prevented or minimized. Because so many dogs are affected by dental and periodontal disease, dental care must be incorporated into each dog's preventive healthcare plan and discussed at every visit (Table 2). The oral examination performed on an awake patient allows the practitioner to design a preliminary treatment plan. However, only when the patient has been anesthetized can a complete and thorough oral examination be performed and an accurate periodontal disease diagnosis and assessment can be made.[87,88] The full extent of oral pathology necessitates periodontal probing and intraoral radiography under anesthesia.[88] When communicating

with the client, the use of images (i.e., dental radiography, before-and-after dental cleaning, photographs of common pathology, and exam-room photographs using intraoral camera options if available), and an oral examination with a dental scoring or assessment may help motivate pet owners to take action before irreversible damage is done to periodontal tissues or repair becomes extensive.[87,89]

Each canine breed and life stage presents its own dental needs and concerns. Certain breeds and sizes of dogs have higher incidence of dental conditions than others.[90–93] For breeds predisposed to certain oral conditions (e.g., small breeds, brachycephalics, and dogs with malocclusions), evaluate the need for early intervention and increased frequency of recommended dental procedures.

Pet owner education is paramount to ensure proper dental care throughout the dog's life. Discuss and demonstrate dental home care options at routine preventive healthcare visits, providing visual, verbal and written information of the benefits and simplicity of effective home care. The Veterinary Oral Health Council registered seal identifies products that help retard plaque and tartar.[94] Discuss avoidance of hard toys, bones, and chews that could damage teeth, and provide recommendations for safe products. A few minutes of chewing are needed for any dental product efficacy and if dogs ingest large pieces, a new dental product is needed.

Comprehensive veterinary dental care is more fully described in recently updated *AAHA Dental Care Guidelines*.[88]

Textbox 1 ***Recommended Timing for Canine Sterilization***

Castration

Small breeds:

6 months of age

Large breeds:

Wait until growth stops (~9–15 months of age)

Ovariohysterectomy

Small breeds:

Prior to anticipated heat cycle (5–6 months of age)

Large breeds:

5–15 months of age*

Note:

Small breeds: < 45 lbs projected adult bodyweight

Large breeds: ≥ 45 lbs projected adult body weight

*Use clinical discretion combined with comprehensive owner education (see Textbox 2) in an effort to balance the benefit of decreasing mammary neoplasia and unwanted litters when done earlier (before the first estrus) versus decreasing the risk of orthopedic disease, some cancers, and urethral sphincter mechanism incompetence if performed later (after growth stops).

Textbox 2 ***Concepts to consider when guiding an owner on the appropriate age for sterilizing their dog.***

1. ***Association does not confirm cause and effect.*** *Much of the spay-neuter literature documents association but not cause and effect.*
2. ***Research confirms breed differences in risk factors for many diseases and conditions.*** *Therefore, it may not appropriate to apply research findings on the timing of sterilization in one breed of dog to all breeds of dogs. Additionally, the population of dogs evaluated in one study may also not be equivalent to that evaluated in another study.*
3. ***The incidence of the conditions attempting to be prevented by sterilization timing should be considered.*** *For example, osteosarcoma is reported to have an overall incidence of 0.2%.[164] In comparison, the incidence of mammary neoplasia in female dogs who are allowed to have one estrus cycle prior to ovariohysterectomy is reported to be 8 percent and 26% percent after a second estrus cycle.[117] However, even this example is complicated by other studies that show the population of dogs that are prone to developing osteosarcoma (primarily large-breed dogs) may not be the same as those with a predisposition to developing mammary neoplasia (primarily small-breed dogs).[165,167]*
4. ***The morbidity and mortality rates of the conditions attempting to be prevented by sterilization timing should be considered.*** *Allowing estrus to occur through delaying ovariohysterectomy increases the risk of mammary neoplasia, a disease with high prevalence, higher morbidity and mortality than the diseases with lower incidence and less causation (cruciate disease, hip dysplasia, urethral sphincter mechanism incompetence, lymphoma, osteosarcoma, hemangiosarcoma)*
5. ***Knowledge of individual breed variation of timing of first estrus will help in determining optimum age for ovariohysterectomy.*** *The age at which first estrus occurs varies among breeds from 4 months in some small breeds to 24 mo in some large breeds, but in general occurs later in large-breed dogs than small-breed dogs.[167] Therefore, categorically delaying ovariohysterectomy in female dogs to 6 months or later, may be after the first estrus in some breeds.*

Reproductive Health

AAHA recommends that all dogs not intended for deliberate breeding be spayed or castrated. For pet owners who choose to breed, practitioners should promote responsible breeding practices including collaboration with research programs to reduce perpetuation of disease through careful selection of breeding individuals.

Sterilized dogs of both sexes have greater average lifespans than intact dogs.[95–100] Sterilization also changes the trajectory of disease acquisition and causes of death.[95,100–103] Better data are needed about the optimal age to sterilize dogs of particular sizes and breeds in order to optimize benefits to health and longevity while minimizing risk of certain diseases.

Although there is emerging data from multiple studies, there is insufficient evidence to draw firm conclusions regarding the relationship between orthopedic disease and the timing of sterilization.[104–109]

Because sterilized dogs live longer, and neoplasia is more frequent at later ages, studies on the effects of sterilization on the diagnosis of neoplasia must be carefully constructed to avoid the confounding risk of age.[97] Risk of certain cancers may be increased or decreased by sterilization timing, varying by tumor and breed. Sterilized dogs are at higher risk than intact dogs for anal gland carcinoma, prostate cancer, osteosarcoma, hemangiosarcoma, transitional cell carcinoma, and mast cell tumors.[110–115] One study showed that the later female rottweilers were spayed, the lower their risk of osteosarcoma.[111] Early-sterilized male golden retrievers had greater risk of lymphoma than late-neutered or intact males, with no sterilization effect on risk among females, while sterilized vizslas of both sexes had greater risk than intact vizslas.[109,116] Conversely, late-sterilized female golden retrievers and early-sterilized vizslas had greater risk of hemangiosarcoma, with no sterilization effect on risk among male golden retrievers and a late-sterilization risk for male vizslas.[109,116] Sterilization was associated with increased risk of mast cell tumor in golden retriever females, with no effect in males, but in vizslas of both sexes.[109,116] Risk of mammary cancer in female dogs shows a reverse effect of timing; spaying prior to first estrus minimizes risk, and risk increases with the number of estrus cycles up to 2.5 yr of age.[117,118,119]

Most, but not all, studies in dogs identify a risk for obesity among sterilized individuals, and the risk of development of obesity in sterilized dogs was greatest in the 2 yr following surgical sterilization.[120–123] Urethral sphincter mechanism incompetence (USMI) is more common overall among spayed females.[124–126] Some, but not all, studies suggest that USMI develops more commonly among females spayed prior to first estrus than those spayed later.[102,122,127,128]

Recommended timing for canine spaying and neutering is summarized in **Textbox 1**. Female and male dogs not intended for breeding and expected to be <45 lbs when full-grown should generally be sterilized by 5–6 mo of age. This age range can be further individualized to the patient with the goals of spaying prior to the first estrus in females to decrease the risk of mammary neoplasia and correcting persistent deciduous teeth during one anesthetic event. As a result of the possible orthopedic concerns, certain cancers in some breeds, and the phenotypical differences between large and giant breeds, males expected to be >45 lbs should be sterilized when growth is complete, usually between 9 to 15 mo.

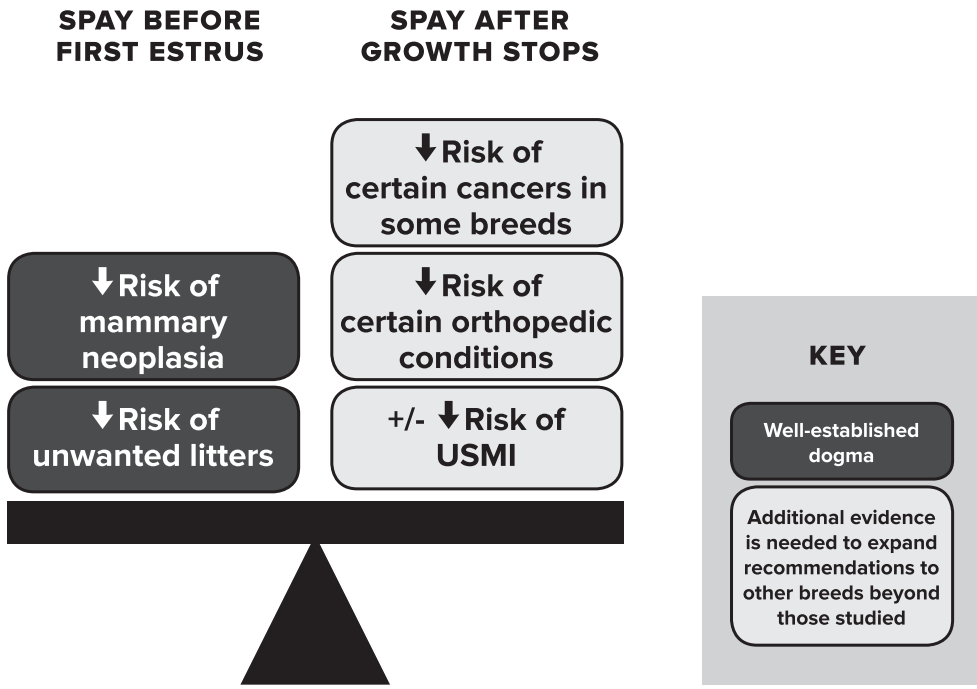

FIGURE 2 *Factors to balance when deciding when to spay a dog expected to be >45lbs. USMI, urethral sphincter mechanism incompetence.*

There may be a benefit to orthopedic health of postponing even longer. The recommendations are less clear in female dogs expected to be >45 lbs; therefore, clinical discretion and extensive client communication (**Textbox 2**) and education will be needed to individualize the care in this population. These recommendations attempt to balance risk of orthopedic disease, USMI, and some cancers associated with early sterilization, against risk of mammary neoplasia, unwanted litters, and possible other cancers if sterilized later (**Figure 2**). These medical recommendations may need to be balanced against certain nonmedical extenuating circumstances, such as likelihood of future access to veterinary care, financial incentives provided by adoption groups, or the opportunity to perform surgical sterilization concurrently with another anesthetized procedure.

Breed-Specific Considerations

Historically, we have recognized that breed-specific physiology and clinical pathological normal values may vary. The evidence-based studies and literature to help guide decision making regarding specific breeds has been limited. Over the last several years, there has been important new information available on this topic.

There are several hundred distinct canine breeds and many more canine mixed-breed combinations, each with different genetics and diverse lifestyles.[129,130] Breeds are recognized by phenotypic characteristics, but the accompanying inherited genetics also drive breed-specific physiology, anatomy, clinical pathology, and disease predisposition. As a result, visual identification of a dog's breed and the initial record entry are not always correct. Therefore, it is important to be as accurate as possible when recording potential breed information (including mixed-breeds) to ensure accuracy in medical records. At least two-thirds of dog breeds have one or more recognized genetic disorders.[131] The new popularity of "designer" breeds, i.e., purposeful crossbreeding, expands the need for breed-specific knowledge. The degree that purposeful canine crossbreeding reduces or magnifies certain genetic traits is not known. Deoxyribonucleic acid testing in mixed-breed dogs may offer information allowing the veterinarian to be watchful for specific breed behavior tendencies or health concerns (e.g., orthopedic, cardiac, ophthalmologic, gastrointestinal or drug sensitivity).

Normal ranges for many test results are reported by species, but variations may routinely occur in selected breeds within a species, for example, red blood cell mass in sighthounds.[132] Hospital- and laboratory-based reference ranges for specific breeds can be useful, but assuring the accuracy of data mining and data entry for specific breeds remains challenging.

Proper breed identification is essential for determining individualized care at all life stages. It is important at the first visit for practice teams to engage in breed-specific education with the pet owner. This dialog should include specific, directed evaluations and diagnostic tests at each life stage for the individual patient in order to detect occult disorders earlier. Various published resources describe breed-specific normal values and disease predispositions; understanding these parameters can help guide decisions for testing in different life stages.[133–140] It can be beneficial for the practice team to designate a "champion" among the staff who is interested in breed-specific issues and can help educate other members of the team on the clinical relevance of breed identity.

Practitioners can increasingly and economically detect breed-specific anomalies with diagnostics that are available in-house. Routine diagnostics such as clinical pathology or imaging may be warranted to detect occult disorders earlier or prior to clinical signs in certain breeds. Examples include abnormal urine protein:creatinine ratio in Wheaton terriers or urinary bladder ultrasound in Scottish terriers. Some less-routine tests may be valuable among predisposed breeds, for example, tonometry and blood pressure.[141–142] Besides early detection, these diagnostic tests are also important to establish a baseline for the individual patient. When a known breed of dog undergoes breed-specific screening, those results should be shared whenever possible in a public database, for example, collie eye screening or hip dysplasia screening.

An increasing diversity of deoxyribonucleic acid–based tests exists for dogs including consumer and medically marketed tests. Practice teams should evaluate insofar as possible any new test for its scientific merits and proven likelihood of disease predictability. Careful consideration must be given to the interpretation (predictive value) of genetic tests that screen for mutations.

Consider evaluating dogs for breed-specific issues that can be prevented or treated at the time of surgical sterilization under a single anesthetic episode (e.g., extracting persistent deciduous teeth, evaluating for unerupted first mandibular premolars, and performing prophylactic gastropexies).

Breed-specific individualized care is of special importance in active or potential working and service dogs where disease can both derive from and impact function.[143–146] Because of the increased level of activity often seen with these dogs and their value increased frequencies of exams and diagnostic testing can be beneficial. A full-lifespan approach should always be used with working or service dogs in scheduling of elective procedures to reduce the total number of anesthetic episodes needed at each life stage.

Baseline Data

A minimum database in the healthy dog may (Table 4) include the complete blood cell count, biochemical profile, urinalysis, electrocardiography, and imaging (e.g., thoracic radiographs, abdominal ultrasound, and echocardiography). Although very limited

data exist, studies evaluating imaging modalities for detection of occult disease in dogs have not provided enough evidence to recommend imaging as a standard component of the minimum database.[147]

The value of a minimum database for detection of occult disease (the presence of disease in the apparently healthy patient) continues to be explored in both human and veterinary healthcare fields. Although there remains limited information in the veterinary field, published information can be used to guide practitioners in their recommendations. These include published guidelines for canine senior care, anesthesia, and several studies that have evaluated the use of a minimum database in the healthy pet.[5,16,148–151] Studies have indicated the presence of abnormalities in 6–80% of evaluated dogs presented for routine primary care appointments or preanesthetic testing, although no studies have included follow-up evaluation to determine the proportion equating to clinically relevant disease processes.[138–140,152–155] Although many of these studies focused on older dogs, one study involving 1,421 apparently healthy dogs of all ages found that significant abnormalities were present in 39.5% of dogs.[156] Clinicians should use their judgement to determine if an abnormality justifies further diagnostic evaluation, additional history or physical examination assessment, or monitoring of the abnormal parameter(s).

Prior to the development of occult disease, it is useful to determine a baseline for each individual dog. Reference ranges provide a wide variation in normal and determining an individual dog's baseline allows for the trending of values over time. Some diseases are diagnosed prior to an elevation above the normal reference range but based on an increase noted over previous levels. Detection of occult disease in all life stages can allow for earlier diagnostic and therapeutic intervention, and the potential for increased healthy longevity. An example is chronic hepatitis that occurs in the young adult life stage of specific dog breeds; this is a condition in which early intervention may halt or delay disease progression.[157,158] Knowledge of breed predisposition to disease will help to guide appropriate selection of tests and timing within life stages for individual dogs. Testing may be more frequent for specific breeds, senior dogs, service dogs, and dogs with a disease process. Consider combining the recommended routine minimum database with tests recommended prior to an elective anesthetic procedure to reduce financial burden on pet owners.

Implementation of a minimum database in all life stages starting with the young adult will complement pet owner education regarding the importance of scheduled veterinary visits in the healthy dog. Pet owner education should include an open discussion regarding the rationale behind the recommendations, the potential benefit to the dog, and financial aspects. Involvement of the entire veterinary team in the implementation of a minimum database will drive the success of this program.

Importance of Practice Team and Pet Owner Compliance

The cost of prevention is often a fraction of the cost of treating a disease or problem once it has become more advanced. Early diagnosis and treatment of developing problems or diseases can improve the likelihood of successful outcome. The increasing ability to share the risk of pet-care costs offers an advantage to the practice team and pet owner alike.

The ultimate goal of preventive care is improved quality of life and longevity for the patient. Comprehensive life stage care permits early detection, treatment, and control of disease resulting in long-term health care cost savings. Studies have found that factors negatively affecting the ability of the practice team to achieve these goals include a client's inadequate understanding of the need for and value of routine examinations, ambiguous practice team recommendations, and unpredictability of the cost of veterinary care.[11,159] The entire practice team's support is crucial in overcoming these obstacles through use of two-way communication and including the pet owner as a team member through eliciting their perspective. Table 3 identifies various online resources that will be useful to the practice team and its pet owners in achieving a team-based approach to individualized pet healthcare.

Approximately one-third of pet owners would not take their pets to the veterinarian were it not for vaccinations.[159] Beginning at the puppy life stage, veterinarians should clearly discuss with the pet owner the need for routine examinations and the monetary value gained in prevention of a disease versus treating it. The practice team should also discuss current and future life stage recommendations with the pet owner to establish owner expectations. As the dog progresses through her life stages, clearly discuss the changing recommendations with the pet owner using two-way communication to decrease owner confusion and make them a pet-care team member (shared decision making). A collaborative approach involving the practice team and the pet owner is generally linked to the best outcomes.[160,161] Table 3 provides additional web-based resources useful to the practice team to make these strong, clear recommendations.

These recommendations should always be made by the veterinarian or technician and reinforced by the entire practice team. Incorporating individualized life-stage recommendations into the practice's reminder systems will indicate to the pet owner that an individualized pet healthcare plan will evolve as the pet ages.[162] When presented with a clear recommendation rather than an ambiguous statement, pet owners are seven times more likely to follow through.[11] Therefore, a strong clear recommendation, even when it is one of several options, should be presented and then a shared decision made with the pet owner by eliciting the pet owner's concerns regarding the recommendation (e.g., "How does that plan sound to you?" or "What

questions or concerns do you have with our recommendation?"). Clear, unambiguous preventive care or diagnostic screening recommendations will also improve the likelihood of early disease detection and a successful clinical outcome. This results in increased pet owner and veterinarian satisfaction, which improves future owner adherence.[12,13,14]

Remaining consistent with conveying the value of routine exams, the cost of life stage–based care must be clearly discussed beginning at the pet's first exam. Pet owners have expressed a desire for more predictability in the cost of care as well as competitive prices for products available through other channels.[148] Preventive healthcare plans have been shown to increase visits, revenue, and provide better preventive care, and pet insurance can share the risk of unpredictable health care costs.[162,163] Therefore, the practice team should clearly discuss the pros and cons of preventive healthcare plans, pet insurance, and various product purchasing alternatives, and be able to make recommendations regarding these options. All of these issues are best addressed by a unified, clear message from a practice team with formal relationship-centered communication training. When this is done, it ensures that the pet owner's perspective is solicited as the basis for an individualized life stage–specific recommendation with a high likelihood of compliance.

Conclusion

A patient's life stage is one of the most relevant aspects of clinical practice because it guides risk assessment, a preventive healthcare plan, and appropriate treatment. A canine patient's life stage also forms the basis for an ongoing dialog with the pet owner about a lifetime healthcare strategy for their pet. This is a critical aspect of the life stage concept because effective client communication is the key factor in pet owner compliance with the practice team's recommendations. Determining the patient's life stage is, in fact, the foundation of an individualized approach to healthcare. Because of the dog's relatively short life span, the transition from one life stage to the next can occur within a short period of time. Thus, a life stage assessment should be performed at each exam visit.

The guidelines recommend that the following 10 health-related factors be evaluated at each life stage for a canine patient: lifestyle effect on the patient's safety, zoonotic and human safety risk, behavior, nutrition, parasite control, vaccination, dental health, reproduction, breed-specific conditions, and a baseline diagnostic profile. These healthcare considerations are best addressed using a collaborative approach to the patient's healthcare, one that involves the entire practice team and the pet owner. These stakeholders should collectively agree on an individualized healthcare plan that continually assesses the patient's health status at each of four life stages (preceding EOL) in the context of regular preventive healthcare visits.

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